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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/056,316	01/22/2002	Alain Duboust	AMAT/6339/CMP/CMP/RKK	2878

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APPLIED MATERIALS, INC.
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EXAMINER	
PARSONS, THOMAS H	

ART UNIT	PAPER NUMBER
1745	

DATE MAILED: 10/30/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

eb4

Office Action Summary	Application No.	Applicant(s)	
	10/056,316	DUBOUST ET AL.	
	Examiner	Art Unit	
	Thomas H Parsons	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 January 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-46* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-46* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *22 January 2002* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *2,3* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: "137" as mentioned on page 9, line 7. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: "154" as mentioned on page 15, line 1. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

3. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: "127" and "128" as shown on Figure 1. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

4. The disclosure is objected to because of the following informalities:

Page 17, line 18, suggest inserting "be" after "may";

Page 18, line 1, suggest changing "show" to --shown--;

Page 22, lines 16, suggest deleting "of";

Appropriate correction is required.

Claim Objections

5. Claim 17 is objected to because of the following informalities:

Line 6, suggest changing "on" to --one--.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claim 44 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 44 recites "The system of claim 41, wherein the electrode...". Claim 41 sets forth a first electrode and a second electrode. Accordingly, it is unclear as to which electrode claim 44 is referring to.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

9. Claims 1-10, 12-22, 24-28, 31-32, 34-40, and 42-46 are rejected under 35 U.S.C. 102(a) as being anticipated by Sun et al.

Claim 1: Sun et al. in Figures 2 and 3 disclose a method for detecting a polishing endpoint, comprising: providing a cell body (20) defining an electrolyte-containing volume (2a), wherein the electrolyte-containing volume contains at least electrolyte; positioning a substrate (workpiece 6) in contact with a polishing pad (3) at least partially submersed in the electrolyte; electropolishing one or more conductive materials on the substrate; and detecting the polishing endpoint of the electropolishing (abs.; and col. 9: 25 - col. 11L 47).

Claim 2: Sun et al. disclose on col. 9: 34-37 causing relative motion between the substrate (workpiece 6) and the pad (3) during the electropolishing.

Claim 3: Sun et al. disclose that electropolishing comprises removing at least a portion of the one or more conductive materials by electrochemical activity (col. 3: 32-48 which discloses "electrochemically promoted anodic dissolution" of metallic layers).

Claim 4: Sun et al. disclose on col. 9: 48 - col. 10: 7 that electropolishing comprises delivering an electrical signal (via potentiostat 5) through the electrolyte between a first

electrode (counter electrode) and a second electrode (working electrode), wherein only the first electrode (counter electrode) is positionable in direct physical contact with the substrate.

Claim 5: Sun et al. disclose that electropolishing comprises delivering an electrical signal through the electrolyte (col. 9: 25 - col. 10: 7; and col. 10: 24-28).

Claim 6: Sun et al. disclose that detecting the polishing endpoint comprises detecting at least one of an increase in a voltage and a decrease in a current of the electrical signal (col. 10: 24-41; col. 11: 8-47; and col. 9: 17-24).

Claim 7: Sun et al. discloses that detecting the polishing endpoint comprises monitoring a signal characteristic of the electrical signal (col. 10: 36-41).

Claim 8: Sun et al. disclose that monitoring the signal characteristic of the electrical signal comprises monitoring at least one of a voltage and a current of the electrical signal (col. 10: 24-41; col. 11: 8-47; and col. 9: 17-24).

Claim 9: Sun et al. in Figures 1 and 2 disclose a method for detecting a polishing endpoint, comprising: providing a cell body (20) defining an electrolyte-containing volume (2a), wherein the electrolyte-containing volume contains at least electrolyte; positioning a substrate (workpiece 6) in contact with a polishing pad (3) at least partially submersed in the electrolyte; establishing a potential difference (via potentiostat 5) between a first electrode (working electrode) and a second electrode (counter electrode) disposed in the electrolyte in order to produce a current through the electrolyte, wherein at least the first electrode (workpiece 6) is not disposed on a polishing surface of the polishing pad (3); electropolishing one or more conductive materials on the substrate; and detecting the polishing endpoint of the

electropolishing according to at least one of the potential difference and the current (abs.; and col. 9: 25 - col. 11: 47) .

Claim 10: Sun et al. disclose that the first electrode (workpiece 6) is disposed on a floor (table 4a which has been construed as a floor) of the cell body (20) below the polishing pad (3) (col. 9: 25 - col. 10: 41).

Claim 12: Sun et al. disclose that polishing the substrate (6) continues for a period of time after detecting the polishing endpoint (col. 10: 24-28; and col. 8: 53 - col. 9: 16 which discloses that polishing continues after initially detecting a polishing endpoint).

Claim 13: Sun et al. disclose on col. 9: 34-37 and 48-53) causing relative motion (via rotational mechanism 1 and worktable 4a) between the substrate (workpiece 6) and the pad (3) during the electropolishing.

Claim 14: Sun et al. disclose that electropolishing comprises removing at least a portion of the one or more conductive materials by electrochemical activity (col. 3: 32-48 which discloses "electrochemically promoted anodic dissolution" of metallic layers).

Claim 15: Sun et al. disclose that detecting the polishing endpoint comprises detecting at least one of an increase in the potential difference and a decrease in the current (col. 10: 24-41; col. 11: 2-43).

Claim 16: Sun et al. disclose initiating a continuing polishing step upon detection of the polishing endpoint (col. 10: 24-28; and col. 8: 53 - col. 9: 16 which discloses that a subsequent polishing step continues after detecting a polishing endpoint during an initial polishing step).

Claim 17: Sun et al. discloses a computer readable medium containing a program (i.e., an electronic potentiostat with internal and external programming means) which, when executed,

performs an operation for detecting a polishing endpoint of an electropolishing process (col. 10: 24-41) occurring for a substrate (workpiece 6) in contact with a polishing pad (3) at least partially submersed in the electrolyte (col. 9: 25 - col. col. 11: 47), the operation comprising: detecting the polishing endpoint of the electropolishing according to at least on of a voltage and a current of an electrical signal delivered through at least the electrolyte (col. 10: 24-41; col. 11: 8-47; and col. 9: 17-24).

Claim 18: Sun et al. disclose that the electropolishing comprises relative motion between the substrate and the pad (col. 9: 34-37).

Claim 19: Sun et al. disclose that electropolishing comprises anodic dissolution induced by the electrical signal" col. 4: 57-col. 5: 1; and col. 5: 14-27).

Claim 20: Sun et al. disclose that electropolishing comprises removing at least a portion of one or more conductive materials on the substrate by electrochemical activity (col. 1: 29-31; and, col. 3: 32-48 which discloses "electrochemically promoted anodic dissolution" of metallic layers).

Claim 21: Sun et al. disclose that the operation further comprises initiating a continuing polishing step upon detection of the polishing endpoint (col. 8: 53-col. 9: 16 which discloses a continual polish upon detection of an initial endpoint).

Claim 22: Sun et al. discloses that the operation further comprises changing a voltage value of the electrical signal after detection of a change in a slope of the electrical signal (col. 8: 38-col. 9: 24; and col. 10: 24-28).

Claim 24: Sun et al. disclose that the operation further comprises changing a voltage value of the electrical signal after detecting the polishing endpoint (col. 8: 38-col. 9: 24; and col. 10: 24-41).

Claim 25: Sun et al. disclose that the detecting the polishing endpoint comprises detecting at least one of an increase in the voltage and a decrease in the current of the electrical signal (col. 10: 24-41 wherein, further, "by measuring and/or detecting a change in a physical (electrical) property as recited on col. 10: 40-41 has been construed as including increasing voltages and decreasing currents; col. 11: 8-47; and col. 9: 17-24).

Claim 26: Sun et al. disclose that monitoring the signal characteristic of the electrical signal comprises monitoring at least one of a voltage and a current of the electrical signal (col. 10: 24-41 wherein, further, "by measuring and/or detecting a change in a physical (electrical) property as recited on col. 10: 40-41 has been construed as including a voltage and/or current; col. 11: 8-47; and col. 9: 17-24).

Claim 27: Sun et al. in Figs. 1 and 2 disclose an electrochemical mechanical polishing system, comprising: a cell body (20) defining an electrolyte-containing volume (2a); a polishing pad (3) disposed in the electrolyte-containing volume; a power supply (5) configured to supply an electrical signal to electrolyte contained in the electrolyte-containing volume; and an endpoint detection system (5) configured to monitor a signal characteristic of the electrical signal to detect a polishing endpoint.

Claim 28: Sun et al disclose a reference electrode (7) (col. 9: 58-col. 10: 7).

Claim 31: Sun et al. disclose controller (electronic potentiostat with internal or external programming means 5) operably connected to the endpoint detection system and configured to initiate a continuing polishing step upon detection of the polishing endpoint by the endpoint detection system (col. 8: 53-col. 9: 16; and col. 10: 24-41)

Claim 32: Sun et al. disclose a controller operably connected to the endpoint detection system and the power supply (electronic potentiostat with internal or external programming means 5) and configured to change a voltage value of the electrical signal upon detection of a change in a slope of the electrical signal (wherein slope equal anodic potential vs time) by the endpoint detection system (col. 8: 38-col. 9: 24; and col. 10: 24-28).

Claim 34: Sun et al. disclose a controller operably connected to the endpoint detection system and the power supply (electronic potentiostat with internal or external programming means 5) and configured to change a voltage value of the electrical signal upon detection of the polishing endpoint by the endpoint detection system (col. 8: 53- col. 9: 24).

Claim 35: Sun et al. disclose an electrolyte container (9) to provide the electrolyte-containing volume with electrolyte (col. 10: 14-19).

Claim 36: Sun et al. disclose that a signal characteristic is at least one of a current and a voltage (col. 10: 24-41; col. 11: 8-47; and col. 9: 17-24; Note also that the recitation "by measuring and/or detecting a change in a physical (electrical) property" on col. 10: 40-41 has been construed as including voltages and currents).

Claim 37: Sun et al. in Figs. 2 and 3 disclose a first electrode (2) disposed in

the electrolyte-containing volume and connected to a first terminal (counter electrode terminal C) of the power supply; and a second electrode (6) disposed in the electrolyte-containing volume and connected to a second terminal (working electrode terminal W) of the power supply (col. 25: 25-col. 10: 7).

Claim 38: Sun et al. disclose the first electrode disposed on a wall of the cell body (Figure 2 shows conduit 2a comprising an electrode as indicated by the hash marks)

Claim 39: Sun et al. in Figures 2 and 3 disclose the first electrode disposed on the pad (3) col. 9: 25-34).

Claim 40: Sun et al. in Figures 2 and 3 disclose the second electrode not disposed on the pad (col. 9: 48-58).

Claim 42: Sun et al. disclose that polishing surface is non-conductive (col. 9: 33-34).

Claim 43: Sun et al. disclose a second terminal (reference electrode terminal R) of the power supply is electrically connected to an electrode (7) disposed in the electrolyte-containing volume (col. 9: 58 - col. 10: 7).

Claim 44: Sun et al. disclose that the wherein the second electrode (6) is not disposed on the pad (col. 9: 48-58).

Claim 45: Sun et al. disclose an endpoint detection system configured to detect the polishing endpoint according to a change in the signal characteristic (col. 9: 17-24; and col. 10: 24-41).

Claim 46: Sun et al. disclose that the signal characteristic is at least one of a current and a voltage ((col. 10: 24-41; col. 11: 8-47; and col. 9: 17-24; Note also that the recitation "by

measuring and/or detecting a change in a physical (electrical) property" on col. 10: 40-41 has been construed as including voltages and currents).

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims 23, 30 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sun et al. as applied to claim 17 above.

Claims 23 and 33: Sun et al. do no discloses disclose that the program comprises a process recipe comprising a plurality of voltage values for the electrical signal and wherein the operation further comprises selecting the voltage values according to polishing transition points.

Sun et al. disclose an electronic potentiostat provided with internal or external programming means known in the art for supplying any variety of desired anodic potential vs time profiles (col. 10: 24-28); and specific voltages levels, intervals, rates of decrease, etc are readily optimized by one of ordinary skill in the art (col. 9: 17-24).

Therefore, in light of the teachings of Sun et al., it would have been obvious to one of ordinary skill in the art at the time the invention was made to have programmed the electronic potentiostat to provide the claimed process recipe and means for selecting voltage values because Sun et al. teaches a programming means that would have provided voltages and the selection

therefor for controllably performing planarization of a substrate surface thereby improving process efficiency, product quality, throughput and reduced costs (col. 13: 49-col. 14: 9).

Claim 30: Sun et al. disclose a controller (electronic potentiostat with internal or external programming means 5) operably connected to the endpoint detection system but do not disclose that it is configured to halt a polishing cycle upon detection of the polishing endpoint by the endpoint detection system.

However, in light of the teaching s of Sun et al. as set forth above in claim, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have programmed the controller (i.e. electronic potentiostat) so that it is configured to halt a polishing cycle upon detection of the polishing endpoint by the endpoint detection system because Sun et al. teaches a programming means that would have provided for controllably performing (halting) planarization depending upon the material and thickness of a substrate surface thereby improving process efficiency, product quality, throughput and reduced costs (col. 13: 49-col. 14: 9).

12. Claims 11, 29 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sun et al. as applied to claim9 and 29 above, and further in view of Easter et al. 6,368,190).

Sun et al. do not disclose a conductive polishing pad, and a first terminal of a power supply electrically connected to the electrically conductive medium.

Easter et al. disclose in Figure 3 a conductive polishing pad (polishing pad 72 with conductive material 76), and a first terminal of a power supply electrically connected to the electrically conductive medium.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have substituted the polishing pad of Sun et al. with the conductive polishing pad and terminal connection of Easter et al. because Easter et al. disclose a conductive polishing pad and terminal connection that would have provided a more even current density across the surface of the polishing pad thereby improving the planarization process, the quality of semiconductor wafers and the process of fabrication integrated circuits.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas H Parsons whose telephone number is (703) 306-9072. The examiner can normally be reached on M-F (7:00-4:30) First Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pat Ryan can be reached on (703) 308-2383. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Thomas H Parsons
Examiner
Art Unit 1745

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Patrick Ryan
Supervisory Patent Examiner
Technology Center 1700